Notice of Allowability	Application No.	Applicant(s)	
	09/739,979	JIN, GARY QU	
	Examiner	Art Unit	
	Eva Yi Zheng	2634	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *7/4/05*.

2. ☒ The allowed claim(s) is/are *1-11*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date *9/14/05* .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Mr. Thomas Adams on September 14, 2005.

The application has been amended as follows:

A) Specification: please replace the paragraph begins on page 2, line 28 with the following:

-- Therefore, in accordance with a first aspect of the present invention there is a provided a method of determining interference between channels in a digital subscriber line (DSL) transmission system employing discrete multitone (DMT) modulation comprising the steps of:

determining a power mask level per channel P(k);

obtaining a channel impulse response (h(n)) after implementation of a time equalization (TEQ) algorithm;

zeroing an integer number (M) of main coefficient values of the channel impulse response (h(n)) to produce a residual impulse response (h'(n));

obtaining from the residual impulse response (h'(n)) a corresponding residual impulse spectrum (H'(k)); and

multiplying the per channel power mask level P(k) and residual impulse spectrum (H′(k)) to obtain a cross-channel interference level. –

B) Specification: please replace the paragraph begins on page 3, line 7 with the following:

-- In accordance with a second aspect of the present invention there is provided a method of estimating cross-channel interference (I(k)) in a discrete multitone (DMT) communication system implemented in a digital subscriber line (DSL) application, the DMT system employing inter-symbol cyclic prefix (M) and time equalization (TEQ), the method comprising:

(a) measuring a total channel impulse response (h(n)) after TEQ;

(b) zeroing an integer number (M) of main coefficients from h(n) to produce a residual impulse response (h′(n));

(c) performing Fast Fourier transform (FFT) analysis on the residual impulse response (h′(n)) to provide a residual impulse spectrum (H′(k)); and

(d) multiplying the residual impulse spectrum (H′(k)) with a measured maximum power per channel value to obtain cross channel interference level (I(k)). –

C) Specification: please replace the paragraph begins on page 3, line 18 with the following,

-- performing a first bit allocation algorithm to obtain a first bit per channel value (b(k)) and a first transmission power level per channel ($P_X(k)$) from a measured noise level per channel (V(k)), a first power mask level per channel (P(k)), a measured channel impulse response (h(n)) and a signal-to-noise ratio requirement (SNR(bn));

obtaining a cross channel interference value (I(k)) based on said measured channel impulse response (h(n));

obtaining a modified noise value ($V_1(k)$) by adding the cross channel interference value (I(k)) to said measured noise value (V(k));

obtaining a second power mask level per channel ($P_1(k)$) based on said first transmission power per channel level $P_X(k)$); and

implementing a second bit allocation algorithm utilizing said modified noise value ($V_1(k)$), said signal to noise ratio requirement (SNR(bn)) and said second power mask level per channel (P1(k))to obtain a final bit per channel allocation ($b_1(k)$). --

D) Please insert the following new paragraphs at page 4, line 1 before the caption "Brief Description of the Drawings":

-- According to yet another aspect of the invention, there is provided a Digital Subscriber Line (DSL) transmission system employing Discrete Multitone (DMT) modulation, having means for determining interference between channels, comprising:

means to determine a power mask level per channel P(k);

means to obtain a channel impulse value h(n) after implementation of a time equalization (TEQ) algorithm;

means for zeroing an integer number (M) of main coefficient values of the channel impulse response to produce a residual impulse response (h'(n));

means for obtaining from the residual impulse response (h'(n)) a corresponding residual impulse spectrum (H'(k)); and

a multiplier to multiply the per channel power mask level and the residual impulse spectrum (H'(k)) to obtain a cross channel interference (I(k)) level.

According to still another aspect of the invention, there is provided a Discrete Multitone (DMT) communication system implemented in a Digital Subscriber Line (DSL) application, said DMT system employing inter-symbol cyclic prefix and Time Equalization (TEQ), and having cross-channel interference (I(k)) estimating means comprising:

a) measurement means to measure a total channel impulse response h(n) after TEQ;

b) means to zero an integer number (M) of main coefficient values from the channel impulse response h(n) to obtain a residual impulse response (h'(n));

c) means to perform Fast Fourier Transform (FFT) analysis on the residual impulse response (h'(n)) to obtain a corresponding residual impulse spectrum (H'(k)); and

d) means for multiplying the residual impulse spectrum (H'(k)) with a maximum power per channel value to obtain a cross channel interference level (I(k)).

According to yet another aspect of the invention, there is provided a DMT communication system implemented in a DSL application employing inter-symbol cyclic prefix and Time Equalization, said system having means for allocating bits per channel comprising;

means for performing a first bit allocation algorithm to obtain a first bit per channel value (b(k)) and a first transmission power level per channel ($P_X(k)$) from a measured noise level per channel (V(k)), a first power mask level per channel (P(k)), a measured channel impulse response (h(n)) and a signal-to-noise ratio requirement (SNR(bn));

means for obtaining a cross channel interference value (I(k)) based on said measured impulse response (h(n));

means for obtaining a modified noise value ($V_1(k)$) by adding the cross channel interference value (I(k)) to said measured noise value (V(k)) ;

means for obtaining a second power mask level per channel ($P_1(k)$) based on said first transmission power per channel level $P_X(k)$); and

means for implementing a second bit allocation algorithm (24) utilizing said modified noise value ($V_1(k)$), said signal to noise ratio requirement (SNR(bn)) and said second power mask level per channel (P1(k)) to obtain a final bit per channel allocation ($b_1(k)$).

According to yet another aspect of the invention, there is provided a receiver for use in a Digital Subscriber Line (DSL) transmission system employing Discrete Multitone (DMT) modulation, the receiver having interference determining means comprising:

means to determine a power mask level per channel P(k);

means to obtain a channel impulse value h(n) after implementation of a time equalization (TEQ) algorithm;

means for zeroing an integer number (M) of main coefficient values of the channel impulse response to produce a residual impulse response (h'(n));

means for obtaining from the residual impulse response (h'(n)) a corresponding residual impulse spectrum (H'(k)); and

a multiplier to multiply the per channel power mask level and the residual impulse spectrum (H'(k)) to obtain a corresponding cross channel interference (I(k)) level.

According to yet another aspect of the invention, there is provided a receiver for use in a Discrete Multitone (DMT) communication system implemented in a Digital Subscriber Line (DSL) application, said DMT system employing inter-symbol cyclic prefix and Time Equalization (TEQ), the receiver having cross-channel interference (I(k)) estimating means comprising:

a) measurement means to measure a total channel impulse response h(n) after TEQ;

b) means to zero an integer number (M) of main coefficient values selected from the channel impulse response h(n) to produce a residual impulse response (h'(n));

c) means to perform Fast Fourier Transform (FFT) analysis on the residual impulse response (h'(n)) to obtain a corresponding residual impulse spectrum (H'(k)); and

d) means to obtain cross-channel interference (I(k)) by multiplying the residual impulse spectrum (H'(k)) with a maximum power per channel value.

According to yet another aspect of the invention, there is provided a receiver for use in a DMT communication scheme implemented in a DSL application employing inter-symbol cyclic prefix and Time Equalization, said receiver having means for allocating bits per channel comprising;

means for performing a first bit allocation algorithm to obtain a first bit per channel value (b(k)) and a first transmission power level per channel ($P_X(k)$) from a measured noise

level per channel (V(k)), a first power mask level per channel (P(k)), a measured channel impulse response (h(n)) and a signal-to-noise ratio requirement (SNR(bn));

means for obtaining a cross channel interference value based on a measured impulse response;

means for obtaining a modified noise value by adding the cross channel interference value to a measured noise value;

means for obtaining a second power mask level per channel based on said first power level per channel; and

means for implementing a second bit allocation algorithm utilizing said modified noise value, a signal to noise ratio requirement and said second power mask level per channel to obtain a final bit per channel allocation. --

E) Specification: please replace the paragraph begins on page 6, line 1 with the following,

-- The interference measurement block 22 of FIG. 4 measures the cross-channel interference level I(k) based on the total channel impulse response h(n) after the time equalization (TEQ) algorithm and the transmission power level Px(k) from the first bit allocation algorithm. The interference I(k) which is the statistically combined interference to channel k from all other channels is added to the measured noise level V(k) and the result $V_1(k)$ becomes the modified noise power level which is provided to the second bit allocation algorithm 24. The interference measurement algorithm, vis. block 22, also outputs the new power mask level $P_1(k)$ to the second bit allocation algorithm 24. The reason for a new power mask level is that the cross-channel interference I(k) is signal

dependent. Since the total noise level increases with cross-channel interference noise being added, the signal transmitting power will be increased as well. Consequently, the cross-channel interference I(k) will be increased which otherwise would result in a repeating loop. The interference measurement algorithm, block 22, calculates the new power mask level $P_1(k)$ based on the pre-calculated transmission power level Px(k) and the maximum power transmitted will be fixed at $P_1(k)$. The calculated interference is based on the maximum possible transmission power $P_1(k)$. Using the new power mask level $P_1(k)$, the signal-to-noise ratio requirement SNR(bn) and the modified noise power $V_1(k)$, the second bit allocation algorithm 24 obtains the final bit allocation $b_1(k)$ and its corresponding transmitting power $Px_1(k)$ which takes into account the aforementioned cross-channel interference. --

F) Regarding claim 4, please replace with the following:

A method of allocating bits per channel in a DMT communication system implemented in a DSL application, said system employing inter-symbol cyclic prefix and Time Equalization, said method comprising;

performing a first bit allocation algorithm to obtain a first bit per channel value (b(k)) and a first transmission power level per channel ($P_X(k)$) from a measured noise level per channel (V(k)), a first power mask level per channel (P(k)), a measured channel impulse response (h(n)) and a signal-to-noise ratio requirement (SNR(bn));

obtaining a cross channel interference value (I(k)) based on said measured channel impulse response (h(n));

obtaining a modified noise value ($V_1(k)$) by adding the cross channel interference value (I(k)) to said measured noise value (V(k));

obtaining a second power mask level per channel ($P_1(k)$) based on said first transmission power per channel level $P_X(k)$); and

implementing a second bit allocation algorithm utilizing said modified noise value ($V_1(k)$), said signal to noise ratio requirement (SNR(bn)) and said second power mask level per channel ($P_1(k)$) to obtain a final bit per channel allocation ($b_1(k)$).

G) Regarding claim 5, after "wherein" please replace word: "a" with – said --; add word: -- level -- after "mask"; delete "level" after "channel".

H) Regarding claim 8, please replace with the following:

A DMT communication system implemented in a DSL application employing inter-symbol cyclic prefix and Time Equalization, said system having means for allocating bits per channel comprising;

means for performing a first bit allocation algorithm to obtain a first bit per channel value (b(k)) and a first transmission power level per channel ($P_X(k)$) from a measured noise level per channel (V(k)), a first power mask level per channel (P(k)), a measured channel impulse response (h(n)) and a signal-to-noise ratio requirement (SNR(bn));

means for obtaining a cross channel interference value (I(k)) based on said measured impulse response (h(n));

means for obtaining a modified noise value ($V_1(k)$) by adding the cross channel interference value (I(k)) to said measured noise value (V(k)) ;

means for obtaining a second power mask level per channel ($P_1(k)$) based on said first transmission power per channel level $P_X(k)$); and

means for implementing a second bit allocation algorithm (24) utilizing said modified noise value ($V_1(k)$), said signal to noise ratio requirement (SNR(bn)) and said second power mask level per channel ($P_1(k)$) to obtain a final bit per channel allocation ($b_1(k)$).

l) Regarding claim 11, please replace with the following:

A receiver for use in a DMT communication scheme implemented in a DSL application employing inter-symbol cyclic prefix and Time Equalization, said receiver having means for allocating bits per channel comprising;

means for performing a first bit allocation algorithm to obtain a first bit per channel value (b(k)) and a first transmission power level per channel ($P_X(k)$) from a measured noise level per channel (V(k)), a first power mask level per channel (P(k)), a measured channel impulse response (h(n)) and a signal-to-noise ratio requirement (SNR(bn));

means for obtaining a cross channel interference value based on a measured impulse response;

means for obtaining a modified noise value by adding the cross channel interference value to a measured noise value;

means for obtaining a second power mask level per channel based on said first power level per channel; and

means for implementing a second bit allocation algorithm utilizing said modified noise value, a signal to noise ratio requirement and said second power mask level per channel to obtain a final bit per channel allocation.

Allowable Subject Matter

2. Claims 1-11 are allowed.

3. The following is an examiner's statement of reasons for allowance:

None of the prior art teaches or suggests a bit allocation system as the current application. In specific, measuring a total channel impulse response after TEQ; zeroing main coefficients values of the channel impulse response to produce a residual impulse response; performing FFT on the residual impulse response and multiplying it with maximum power per channel level to obtain cross channel interference level.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eva Y Zheng whose telephone number is 571 272-3049. The examiner can normally be reached on M-F, 7:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on 571 272-3056. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Eva Yi Zheng
Examiner
Art Unit 2634

September 14, 2005

SHUWANG LIU
PRIMARY EXAMINER